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Relationship between Feed Efficiency Measures during the Heifer Development Stage and Measures Taken During First Lactation in Purebred Angus—Second Year Progress Report

Daryl R. Strohbehn
Iowa State University

Garland R. Dahlke
Iowa State University

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Daryl Strohbehn, professor of animal science;
Garland Dahlke, extension program specialist;
Iowa Beef Center

Summary and Implications

Angus first-calf heifers were evaluated for feed intake utilizing the Feed Intake Monitoring System developed at ISU. Average dry matter intake for the feeding period was 3904 pounds with a 3100 pound difference in dry matter intakes from the lowest to the highest intake female in year one while in year two there was over a 1425 lb difference in dry matter intake. This quantified to low to high spread in daily dry matter intake was 17.5 to 46.6 pounds. Feed intake during first year lactations between negative and positive RFI groups appears small after two years of observation.

Introduction

Feed costs represent about 60 percent of total costs to maintain a beef cow herd in the U.S. As land continues to escalate in value, a resulting increase occurs in grazing costs, stored feeds and supplementation procedures. Past studies in the feedlot industry show that improvements in feed efficiency reduce costs of production nearly five times more than improvements in growth rate. Current research in the genetics of feed efficiency centers predominantly around growth from weaning to harvest time and fewer projects address the implication of improvements with breeding females. Additionally, no U.S. projects currently involve cattle with a historical background of selection for feed efficiency. This project is meant to address the furthering of knowledge on feed utilization in Angus females following their first calving and subsequent weaning of the calf. The purpose of the current study is to determine if heifers evaluated for feed efficiency during their growth phase from weaning to yearling have similar rankings in feed utilization for continued developmental growth and milk production during the nursing stage with their first calves.

Material and Methods

Heifers used in 2008 and 2009 of a three year project were evaluated at Wardens Farm, Council Bluffs, Iowa for feed intake, gain and resulting feed conversion and residual feed intake during the weaning to yearling development period. This was done using a pelletted ration fed through PinPointer 4000 feed intake systems. The pellet used contained net energy for maintenance and gain of .74 and .46 mcals per pound of dry matter, respectively, with a protein content of 14 percent. Long stem, predominantly brome grass, hay was offered at 3-4 pounds daily. This was not accounted for in the feed efficiency calculations. At yearling time all heifers were evaluated for carcass traits using certified ultrasound procedures. Heifers were artificially and naturally serviced to one bull, thus reducing calf genetic variation. Average weaning and yearling performance in addition to feed intake and efficiency data is shown in Table 1.

All heifers were calved by Wardens Farm and then transported post-calving to the Iowa State University Beef Nutrition Farm, Ames, Iowa. These first-calf heifers and their calves received Radio Frequency ear IDs which work in concert with the Feed Intake Monitoring System (FIMS) as described in AS Leaflet R R2279, 2008 ISU Animal Industry Report. In addition to the feeding facility barn, the first-calf heifer pairs were managed in two drylot areas adjacent to and with complete access to the FIMS barn. The drylot grass areas measured 181’ x 100’ and 181’ x 80’ for a total of 32,580 square feet. These were closely mowed utilizing a rotary mower to eliminate grass growth so an insignificant amount of grass was available for consumption, yet it provided a cleaner and drier area for sound nursing and calf rearing. All feed fed to the heifers was offered through the FIMS with it serving as a general loafing barn with all gates kept open. Heifer pairs were allowed access to any and all FIMS bunks within six of the seven pens. The seventh pen was used as a loafing area closed off for access only by the calves.

A forage-based ration was fed ad libitum which met NRC requirements for maintenance, heifer growth and milk production levels associated with Angus genetics of this type (see Table 2). All feedstuffs were analyzed utilizing a commercial feed testing laboratory. Heifers and calves were weighed at monthly intervals and during that activity, heifer milk production was measured via the weigh-suckle-weigh technique.

At approximately 60 days post-calving heifers were bred artificially using the Co-Synch+CIDR synchronization system in 2008 and the 5-day CO-Synch+CIDR system in 2009 and then exposed to a natural service sire for two estrus cycles or 45 days. Calves were weaned at an average age of 185 days.

Table 1. Performance of heifers up to yearling time.

Traits	Average	Minimum	Maximum
Feed intake test			
Total dry feed intake, lb	1922	1617	2309
Average daily dry matter intake	22.6	19.3	27.5
Test ADG	2.23	1.02	3.48
Unadjusted feed conversion	10.6	6.3	21.9
Adjusted feed conversion	10.6	6.2	20.9
Residual feed intake	-0.07	-2.39	1.75
Growth			
Birth weight, lbs	76	60	90
Adjusted 205 weight, lbs	619	531	713
Adjusted 365 weight, lbs	963	799	1108
EPDs			
Birth weight, lbs	0.7	-1.7	2.5
Weaning weight, lbs	44.6	35	53
Maternal Milk, lbs	22.5	15	29
Yearling weight, lbs	77.0	57	90
Ultrasound Traits			
Adjusted Ribeye area, sq.in.	11.49	9.2	13.6
13th Rib fat cover, in.	0.57	0.21	0.88
Adjusted % Intramuscular Fat	6.90	3.81	9.53

Table 2. Composition of rations fed during feed intake measurement.

Feed ingredient	Period 1	Period 2
Year 1 - 2008	**% on Dry Matter Basis May 28-June 22**	**% on Dry Matter Basis June 23-October 17**
Fescue hay	57.4	38.6
Soybean hulls	15.1	43.6
Wet distillers grains	17.4	9.8
Molasses	9.6	7.4
Customized cow mineral	0.5	0.5
Year 2 - 2009	May 28-October 8	
Corn silage	57.1	
Fescue hay	33.0	
Modified Distillers Grain	8.6	
Urea	0.3	
Custom cow mineral	1.0	

Results and Discussion

Fifteen and 14 first-calf heifers were transported to the ISU beef nutrition farm in late May of 2008 and 2009, respectively,, and were immediately started on feed in the FIMS system. Starting in late May heifers were monitored for daily feed intake for about 140 days. Early on in the first year trial (day 21) it was determined that ration sorting was occurring, so to alleviate that problem ration reformulation was done to allow a liquid molasses addition to take place (see Table 2). In year two corn silage was utilized in the ration and no sorting problems were noticed. Due to ration dryness in year one some cows became habitual in flipping feed from the bunk system and adjustments to their intakes were necessary. Considerable rain fell during the month of June in year one making lot conditions challenging, yet persistent barn cleaning and bedding kept conditions acceptable. However, late in June coccidiosis went through the calves eventually causing the death of one nursing calf and weakening another such that it succumbed to respiratory disease in late August.

In year one first-calf heifers gained more than desired in body weight and increased by 1.1 in body condition score during the feeding period for an average of 7.7 (see table 3). However, in year two with the significant ration change the heifers had virtually no weight or condition score change. Milk production as determined by the calf weigh-suckle-weigh procedure averaged 8.2 lbs for a 12 hour period. The nursing calves gained on average 2.31 lbs daily.

Table 3. Performance of 1st calf heifers during lactation.

Traits	Average	Maximum	Minimum
Start weight, lbs	1256	1385	1055
End weight, lbs	1359	1680	1080
Weight change lbs	98	320	-72
Start body condition score	6.6	9	5
End body condition score	7.2	9	5
12 hour milk production, lbs	8.2	14.0	2.0
Beginning calf weight, lbs	183.2	286	75
Ending calf weight, lbs	498.5	634	296
Feed intake test			
Total dry matter intake, lbs	3904	6610	2200
Daily dry matter intake, lbs	28.9	46.6	17.5

Daily feed intakes for individual cows varied a great deal on a day to day basis, but also for the entire feeding period (see table 3). The average daily dry matter intake was 28.9 pounds with a total intake of 3904 pounds for the feeding period. Of interest, of course, is the variation across the herd in total intake and how efficiently these cows convert feed into milk and calf gain. In the initial year there was over a 3100 pound difference in dry matter intakes from the lowest to the highest intake female while in year two there was over a 1425 lb difference in dry matter intake.

Top half RFI yearling heifers were compared to bottom half RFI heifers in table 4. As seen in the yearling development stage top half RFI heifers gained slightly less on test, but consumed 212 less dry matter than bottom half RFI heifers resulting in feed conversion differences. During their first lactation top half RFI heifers on average consumed slightly more dry matter, but this average is inconsistent at this time when you look at the year averages. Top half RFI heifers had calves which gained less during the period in both years. It is important to notice at this time top half RFI heifers had calves which started on trial about 20 days younger and there was a significant calf sex split difference between the two groups favoring the bottom half RFI heifers.

Table 4. Averages for Yearling Heifer RFI Groups when split into top vs. bottom halves.

Traits	Top 1/2 2008	Top 1/2 2009	Average of Top 1/2	Bottom 1/2 2008	Bottom 1/2 2009	Average of Bottom 1/2
Number of females	5	6	11	4	8	12
Yearling Time Information						
Start wt. on yearling test	780	706	746	816	725	773
End wt. on yearling test	914	941	930	976	946	961
ADG during yearling test	1.57	2.79	2.18	1.90	2.58	2.24
Yearling RFI	-0.88	-1.20	-1.04	1.26	0.66	0.96
Yearling Adj. F:G	13.6	7.3	10.4	13.2	8.5	10.8
Yearling total feed intake	1775	1859	1817	2047	2012	2029
2 Year Old Time Information						
Cow Start wt.	1198	1275	1237	1199	1221	1210
Cow End wt.	1478	1291	1385	1490	1215	1352
Cow BCS	8.2	6.7	7.4	8.0	6.8	7.4
12 hr milk production, lbs	9.6	6.8	8.2	7.4	8.9	8.1
Calf age at test start	30.2	49.8	40.0	54.0	65.6	59.8
Beginning calf weight, lbs	115	198	157	168	230	199
Ending calf weight, lbs	394	495	445	544	555	549
Calf ADG	1.92	2.27	2.10	2.57	2.47	2.52
Daily dry matter intake, lbs	36.03	24.02	30.02	34.87	24.91	29.89
Total dry matter intake, lbs.	5116	3026	4071	4951	3139	4045

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Figure 1. Cow eating out of FIMS bunk.

Figure 2. Cows and nursing calves in drylot loafing area.